

REMARKS

At the time of the present Official Action, claims 1 and 32-76 were pending, with claims 37, 40, 52, 55, 67, and 70 being objected to, and claims 1, 32-36, 38, 39, 41-51, 53, 54, 56-66, 68, 69, and 71-76 being rejected. By this Amendment, claim 1 has been cancelled without prejudice. Reconsideration of the application as amended is respectfully requested.

Double Patenting

The Examiner rejected claim 1 under 35 U.S.C. § 101 as claiming the same invention as that of claim 1 of prior U.S. Patent No. 5,952,671.

Applicants allowed claim 1 of the original application to remain in this continuing application to ensure co-pendency. Because this claim has issued in a related patent, Applicants hereby cancel claim 1 without prejudice. Therefore, the Examiner's rejection under 35 U.S.C. § 101 is now moot.

The Examiner rejected claims 32-34, 41-49 and 56-61 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-4 of U.S. Patent No. 5,952,671. Specifically, the Examiner stated:

Claims 32-34, 41-49 and 56-61 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-4 of U.S. Patent No. 5,952,671. Although the conflicting claims are not identical, they are not patentably distinct from each other because it is well known that a first electrode, a memory material and a second electrode constitute a memory element; and the memory element and the access device together forming a single memory cell. Therefore, it would have been obvious to one of ordinary skill in the art that the memory

element operatively coupled to the access device in order to function as a single memory cell. Furthermore, the memory material in U.S. Patent No. 5,952,671 comprises the claimed chalcogenide material, it is obvious that all the functions and characteristics recited in the claims 42-43, 45-46, 57-58, 60-61 are inherent characteristics of the memory material in response to electrical stimulus.

Although Applicants do not necessarily agree with the Examiner's rejection, Applicants recognize that filing a Terminal Disclaimer to obviate this rejection will facilitate the prompt issuance of a patent without any real loss of patent term or other rights for the Assignee. Since the present application claims priority to the '671 patent, under 35 U.S.C. § 154 the term of the '671 patent and any patent issuing from the present application will expire twenty years from the date of the earliest original filing, i.e., May 9, 1997, regardless of whether a Terminal Disclaimer is filed. Although the Terminal Disclaimer further requires that the Assignee maintain common ownership of these patents, the Assignee has no intention of dividing ownership in any event. Accordingly, Applicants hereby submit a properly executed Terminal Disclaimer to obviate the Examiner's obviousness-type double patenting rejection.

Rejections Under 35 U.S.C. § 103

The Examiner rejected claim 1 under 35 U.S.C. § 103(a) as being unpatentable over Buckley (US 3,886,577) in view of Klersy et al. (US 5,536,947). Specifically, the Examiner stated:

Buckley discloses a memory cell (Fig. 6) comprising: an access device (28, 30) formed on a semiconductor substrate 2'; a layer 2a' of dielectric material disposed on said access device, said layer of dielectric material having a pore 24 therein; a first layer 4' of conductive material disposed within said pore to form a first electrode; a layer (6', 32) of structure changing material disposed

on said first electrode; and a second layer 8a' of conductive material disposed on said layer of structure changing material to form a second electrode. The current photolithographic limit is about 0.2 μm . Buckley does not disclose the pore diameter is smaller than 0.2 μm . Klersy et al. discloses a memory cell wherein the pore diameter is as low as 0.01 μm (col. 17, lines 20-23). It would have been obvious to a person having ordinary skill in the art at the time the invention was made to form the pore diameter of Buckley as small as taught by Klersy et al. in order to lower the energy requirements for electrical switching.

Claim 1 has been cancelled for the reasons discussed above, so this rejection is now moot. However, Applicants respectfully submit that the Examiner has misinterpreted the Buckley reference and the Klersy reference, along with the manner in which the two references may be combined, as discussed in greater detail below. Thus, for at least these reasons, Applicants respectfully traverse the Examiner's rejection in any event.

The Examiner rejected claims 32-33, 38-39, 41-48, 53-54, 56-63, 68-69 and 71-76 under 35 U.S.C. § 103(a) as being unpatentable over Buckley (US 3,886,577) in view of Klersy et al. (US 5,536,947). Specifically, the Examiner stated:

Buckley discloses an X-point memory cell (Fig. 6) comprising: an access device (28, 30); a memory element 1' operatively coupled to the access device, the memory element comprising: dielectric material 2a' having a pore 24 therein; a first electrode 4' disposed within the pore; a memory material (6', 32) disposed over the first electrode (8a', 8b') disposed over to the memory material. The current photolithographic limit is about 0.2 μm . Buckley does not disclose the pore diameter is smaller than 0.2 μm . Klersy et al. discloses a memory cell wherein the pore diameter is as low as 0.01 μm (col. 17, lines 20-23). It would have been obvious to a person having ordinary skill in the art at the time the invention was made to form the pore diameter of Buckley as taught by Klersy et al. in order to lower the energy requirements for electrical

switching. Buckley further disclose a first conductive line 26 extending in a first direction; a second conductive line 33 extending in a second direction different than the first direction, the first conductive line and the second conductive line being spaced apart by a portion of a substrate, the second conductive line intersecting the first conductive line in an overlapping manner to form an area of intersection in the portion of the substrate, the access device (diode) wholly disposed in the area of the intersection, the access device (diode) being operatively coupled to the first conductive line, the memory element 1' wholly disposed in the area of intersection.

Regarding claims 33, 48, and 63, the access device (30, 28) comprises a diode.

Regarding claims 28, 53, and 68, the second electrode is comprised of a plurality of layers (8a', 8b').

Regarding claims 39, 54 and 69, the second electrode is comprised of a plurality of materials.

Regarding claims 41-46, 56-61 and 71-76, the memory material 6' comprises structure changing material of a chalcogenide material which inherently changes between different states of crystallinity in response to electrical stimulus, wherein each of the different states of crystallinity corresponds to a given resistance level. The chalcogenide material comprises a programmable resistive element that changes between different resistance levels in response to electrical stimulus.

Applicants respectfully traverse this rejection. The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention absent some teaching or suggestion supporting the combination. *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 732 F.2d 1572, 1577, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984). Accordingly, to establish a *prima facie* case, the Examiner must not only show that the combination includes *all* of the claimed elements, but also a

convincing line of reason as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985). When prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988).

The Buckley reference discloses a memory cell having a digit line 26 coupled to a diode 28, 30. The diode is coupled to an electrode 4 that is disposed within an opening 24 in a layer of dielectric material 2a. A chalcogenide element 6, 32 is deposited over a portion of the dielectric material 2a and into the opening 24. An electrode 8a, 8b of even greater width is deposited over the chalcogenide material 6, 32, and a word line 33 is deposited over the electrode 8a, 8b in a direction perpendicular to the digit line 26.

The Examiner has misinterpreted the teaching of the Buckley reference at least to the extent that the Examiner suggests that the Buckley reference discloses an X-point memory cell. Indeed, as defined in the present application, the largest dimension of an X-point memory cell is the size of the crossing area of the word line and the digit line (page 14, lines 9-17). In other words, the other elements that make up the memory cell, such as the memory element and the access device, fit vertically within the area defined by the intersecting widths of the word line and digit line. In the Buckley reference, however, it is clear that at least the n-doped portion 28 of the diode, the chalcogenide element 6, 32, and the upper electrode 8a, 8b each extend to a width

greater than the width of the digit line 26. Furthermore, the Buckley reference does not provide an orthogonal cross-sectional view nor a top view to determine whether any of these elements is wider than the width of the word line 33. Therefore, the Buckley reference clearly does not disclose an X-point memory cell where the access device is wholly disposed in the area of the intersection of the digit line 26 and the word line 33 or where the chalcogenide memory element is wholly disposed in the area of intersection, as asserted by the Examiner.

In regard to the Klersy reference, it discloses nothing more than the prior art memory cell described in the present application on page 5, lines 7-23. The memory cell disclosed in the Klersy reference exhibits many of the disadvantages that the present invention overcomes. Specifically, the Klersy memory cell is inoperative until the dielectric layer 48 is “popped” by a current that is much higher than the current required to program or read the memory cell. The Klersy reference clearly supports this assertion by stating that higher current pulses must be delivered to the newly constructed memory element until the layer 48 breaks down, and that subsequent lower current electrical cycling can then take place for programming and reading. *See Klersy, col. 17, line 56, to col. 18, line 17.*

Furthermore, the Klersy reference does not overcome the deficiencies of the Buckley reference discussed above. The Examiner should note that the Klersy reference fails to disclose an access device coupled to the memory cell. Nevertheless, the access device undoubtedly would be formed in the substrate 10, and the size of the access device certainly would be wider than other portions of the memory cell due to the very high currents that it must carry to break down the dielectric layer 48. Thus, the Klersy reference also fails to disclose an X-point memory cell.

Finally, even a cursory review of the present application and claims reveals that, to the extent the present memory cell can be compared to the memory cell of Klersy, the pore discussed and claimed in the present application is analogous to the pore in the dielectric layer 46 of the Klersy reference -- not a pore in the dielectric layer 48. As discussed in the present application, it is crucial to reduce the current-carrying duties of the access device to produce a smaller cell. The way to reduce the size of the access device is to reduce the amount of current it must carry. Since any memory cell that uses "popping" to form a path through the chalcogenide material requires even higher current, any such memory cell must be considered as teaching away from the present technique. Furthermore, since "popping" cannot produce paths that are relatively uniform in size, the resulting arrays of memory cells are virtually useless. Only by decreasing the repeatable size of the pore in the dielectric layer analogous to the dielectric layer 46 and by removing the dielectric layer 48 (and thus removing the need for "popping") can the size of access devices be decreased and uniform paths be formed amongst memory cells in an array.

In view of the remarks set forth above, Applicants respectfully request withdrawal of the Examiner's rejection and allowance of the rejected claims.

The Examiner rejected claims 34, 49 and 64 under 35 U.S.C. § 103(a) as being unpatentable over Buckley (US 3,886,577) in view of Klersy et al. (US 5,536,947) as applied to

claims 32, 47, and 62 above, and further in view of Wang et al. (US 4,616,404). Specifically, the

Examiner stated:

The modified Buckley as described above discloses p-region 30 disposed adjacent n-region 28 forming a diode. Buckley does not disclose p-region 30 comprising polysilicon and n-region 28 comprising polysilicon. Wang et al. discloses a polysilicon diode comprising a layer of N doped polysilicon and a layer of P doped polysilicon. It would have been obvious to a person having ordinary skill in the art at the time the invention was made to form the p-region 30 of polysilicon and the n-region 28 of polysilicon to form a polysilicon diode with low reverse current leakage and low series resistance permitting high current flow.

Because the Wang reference clearly does not cure the deficiencies of the Buckley and Klersy references, these claims are believed to be allowable for the reasons discussed above.

The Examiner rejected claims 35-36, 50-51, and 65-66 under 35 U.S.C. § 103(a) as being unpatentable over Buckley (US 3,886,577) in view of Klersy et al. (US 5,536,947) as applied to claims 32, 47, and 62 above, and further in view of Ovshinsky et al. (US 5,414,2710).

Specifically, the Examiner stated:

The modified Buckley as described above does not disclose the first electrode 4' comprised of a plurality of layers and a plurality of materials. Ovshinsky et al. discloses the first electrode comprising two layers (32 and 34) of different materials (carbon and molybdenum). It would have been obvious to a person having ordinary skill in the art at the time the invention was made to form the first electrode 4' of the modified Buckley comprising two layers of the materials as taught by Ovshinsky et al. in order to form excellent electrical contacts with the memory material 6'.

Because the Ovshinsky reference clearly does not cure the deficiencies of the Buckley and Klersy references, these claims are believed to be allowable for the reasons discussed above.

Conclusion

In view of the remarks and amendments set forth above, Applicants respectfully request withdrawal of the outstanding rejections and allowance of claims 32-76.

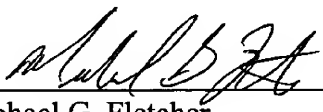
If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

General Authorization for Extensions of Time

Although no fee is currently believed to be due, in accordance with 37 C.F.R. § 1.136, Applicants hereby provide a general authorization to treat this and any future reply requiring an extension of time as incorporating a request therefor. Furthermore, Applicants authorize the Commissioner to charge the appropriate fee for any extension of time to Deposit Account No. 13-3092; Order No. MCRO:0106--2/FLE (95-0412.02).

Respectfully submitted,

Date: February 27, 2002



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